

REMARKS

This application has been carefully reviewed in light of the Office Action dated August 19, 2008. Claims 6, 18, 19 and 26 are in the application, of which Claims 6, 18 and 26 are independent. Reconsideration and further examination are respectfully requested.

All claims were rejected under 35 U.S.C. § 103(a) over U.S. Patent 7,059,699 (Asauchi) in view of French 2,579,856 (Courtin). Reconsideration and further examination are respectfully requested, as explained in more detail below.

Before proceeding with such explanation, however, it is noted that although an English language abstract was provided by the USPTO in connection with the Courtin document, the document itself is in French. Diligent searching did not locate any English language counterparts to Courtin. Accordingly, the Applicant has obtained a machine-generated translation of Courtin, which is attached to this Amendment. As noted, the translation is machine-generated, and it has not been reviewed by anyone conversant in both French and English. Naturally, therefore, it contains many inaccuracies and is clearly non-idiomatic. Nevertheless, it is felt that the submission of this machine-generated translation will facilitate a general understanding of the technology described by Courtin.

Turning to the rejection, all claims have been amended so as to specify that the mechanism for sucking and delivering liquid has a plurality of syringes, and also to specify that the claimed liquid section and the claimed liquid ejection section are constructed to move independently of each other.

Advantageously, therefore, because the liquid supply section and the liquid ejection section are constructed to move independently of each other, it is still possible to

supply plural types of liquid speedily and efficiently, due to the feature that the mechanism for sucking and delivering has a plurality of syringes.

In contrast, Asauchi is not seen to describe a structure in which a liquid supply section and a liquid ejection section are constructed to move independently of each other. In Asauchi, print head 28 is designed to mount plural ink tanks, namely, ink tanks 107F and 107K. Thus, Asauchi's ink tanks are not arranged for independent movement relative to print head 28. Asauchi therefore fails to disclose or to suggest at least the feature of a liquid supply section and a liquid ejection section that are constructed to move independently of each other.

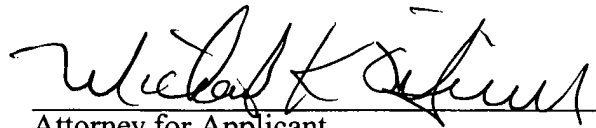
In entering the rejection over Asauchi in view of Courtin, the Office Action conceded that Asauchi does not disclose a mechanism for sucking and delivering liquid. Applicant agrees with this assessment, and respectfully submits that as a logical consequence of the absence of such structure from Asauchi, Asauchi has no need to provide a separate mechanism for transporting ink from its ink tanks to the print head. Hence, Applicant respectfully submits that there is no rational motivation to employ the syringe of Courtin in the device of Asauchi.

Moreover, even if those of ordinary skill would have had some rationale for using the syringe of Courtin in the device of Asauchi, the arrangement set out in the claims would still not have resulted. More particularly, according to the claims, the mechanism for sucking and delivering liquid has a plurality of syringes. No such arrangement is shown or suggested, even if Courtin were combined with Asauchi.

It is therefore respectfully submitted that the claims herein recite subject matter that would not have been obvious from any permissible combination of Asauchi and Courtin, and allowance is respectfully requested.

Applicant's undersigned attorney may be reached in our Costa Mesa, California office by telephone at (714) 540-8700. All correspondence should continue to be directed to our address given below.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Michael K. O'Neill", written over a horizontal line.

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FCBS_WS 2725854v1

Machine-generated translation of FR 2 579 856, obtained from
<http://translate.google.com> on September 17, 2008, based on French text retrieved from
<http://v3.espacenet.com/textdoc?DB=EPODOC&IDX=FR2579856&F=8>

Publication number: FR2579856

Publication date: 1986-10-03

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Classification:

- international: B05C11/10; B43L13/02; H05K3/12; B05C11/10; B43L13/02; H05K3/12;
(IPC1-7): H05K3/10; G01D15/16

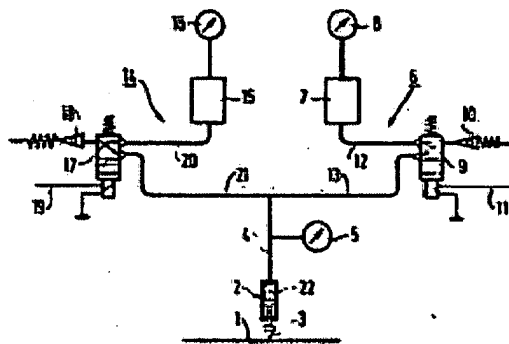
- European: B05C11/10; B43L13/02B1; H05K3/12C

Application number: FR19850004700 19850328

Priority number(s): FR19850004700 19850328

Abstract of FR2579856

Machine intended for producing hybrid circuits by ink deposition 22 on a substrate 1 such as an alumina plate. It comprises a remote-controlled writing head 2 and a device 6, 4 for controlling the ink supply to this head. The writing head is equipped with a writing nozzle 3 in the form of a glass capillary tube.



Operative and writing process for carrying out electrical circuits.

The present invention relates to a machine for the realization of printed circuit boards, such as printed circuit on

5 Alumina called "circuitshybrides, by deposition of ink on a substrate with a head writing remote, the command is usually made from a computer.

10 The achievement, starting a scheme electric, hybrid circuits screen classic has the disadvantage of a lead time of execution long enough (three to four months) and a price relatively high. When one is interested only in the completion of a prototype. The use for the production of prototypes, technology writing ink pen, allows one hand saves time for the realization of these circuits prototypes, and secondly to lower the cost while by adding a quick way to make changes of location.

15 It already contains devices intended to deposit the ink on a substrate for the realization of electrical circuits, including a head writing and a remote control device for the supply of ink said head operating normally by creating an excess or depression, depending on whether you want to start or stop writing. The following publications - PROCEEDING 4th European Hybrid Microelectronics Conference 1983,
20 Copenhagen, p. 291 to 298 - Patent Application PCTNO WO 84/01825 describe examples of such achievements.

25 It was noted with these devices, which have traditionally ink jet steel or ceramic, defects marking occurring generally either at the beginning or end of line, defects that are most likely due to the materials used in the constitution these buses filing of ink, in combination with the characteristics of corrosion and tixotropie these special inks, for printing electrical circuits.

30 The invention therefore relates to a device intended to deposit the ink on a substrate for the realization of electrical circuits, improved performance compared to devices of this type known so far. Such a device is the type with a head writing and a remote control device for the supply of ink that head by creating an excess or a depression, according to what one wants to trigger or stop writing. And it is wherein the head of writing is equipped with a nozzle-shaped tube and glass capillary, or similar material of the same physical
35 and chemical properties.

40 It will be noted in passing that the use of such an application, a nozzle-shaped glass hypodermic needle, is not normally in the human spirit trades, as it will tend to reject prima facie such a solution because of a priori brittle nature of such a nozzle and the difficulty of obtaining a regular hole a hundred microns in diameter.

The invention also relates to a process of implementing such a system, wherein to create, at the end of stroke, depression sufficient to allow the ink back into the nozzle on substantially all length thereof. This ensures, in writing the following trait, a speed of ink
45 before its appearance on the tip of the nozzle sufficient to give a fluidity to avoid the

formation of a "pie" early deals. Preferably moreover, is made in order to avoid excessive loss of fluid ink between two write cycles, a cycle waiting with up to pressure and depression alternating and intended to make the ink paths and go back through the nozzle without its way outwards.

5

The invention will be better understood using the following description of a practical example, in reference to the drawings in which - Figure 1 is a schematic representation of a machine writing electrical line with the invention - Figure 2 is a side view of the larger nozzle deposit ink equipping the machine in Figure 1, - Figure 3 is a diagram to put
10 pressure and depression of the nozzle of the machine in Figure 1 during one cycle of writing an electrical circuit - Figure 4 is a simplified diagram of the cycle waiting applied to the machine of invention between two cycles of writing, for example, two electrical circuits different on the same substrate or on two different substrates.

15 Figure 1 represents a machine intended to file, such as control of a microcomputer, a conductive ink on a substrate 1, for example, a plate Alumina, with a view to achieving an electrical circuit. The special ink is contained in a syringe, or reservoir, water-resistant and 2 is applied to the substrate 1 through a nozzle 3 tube-shaped hair.

20 The syringe 2 is trained by moving a classic, unrepresented, classically ordered by a microcomputer.

The ink itself is performed by a device put pressure or depression of the syringe containing 2 - 4 a tube led to a pressure or vacuum on the reservoir 2, equipped
25 represented as a gauge Control 5, - a circuit 6-up pressure, connected to the tube 4, and a pressurized tank 7 equipped with a pressure gauge control 8, an electro-valve 9 equipped with a valve 10 Update the open air and commanded by an entry of 11 electrical signal, and pipelines interconnections 12 and 13 - 14 symmetrically a circuit implementation depression, connected to the tube 4, and a depressurized tank equipped with a 15 16
30 gauge control, a 17 valve fitted with a valve from 18 to vent and commanded by an entry of 19 electrical signal, and pipelines interconnections 20 and 21.

The capillary nozzle, or hypodermic fitted syringe 2 is a magnified view represented in Figure 2. It consists of a capillary tube which, according to the invention, is a glass or
35 material similar physical and chemical properties of hardness, p \hat{o} li and resistance to solvents, such as quartz. It is set on the syringe containing 2 special ink 22 through a joint 23 and a metal fasteners and protection 24. The syringe 2 is also metal. In the example in question, the nozzle at a length of about 20 millimeters, its internal channel has a maximum diameter of about 2 millimeters, 25 and his mouth has a diameter of about 100
40 to 200 microns.

The functioning of the device in Figure 1 is as follows
Initially, the two valves 9 and 17 are assumed to be at rest in the position shown in Figure 1, in which the pipes 13 and 21 are connected to the open air. No pressure or depression
45 is supposed to be applied on the syringe 2 by piping 4 and ink 22 is therefore still in it,

the nozzle section 3 is too low for internal ink that can be sell down under the effect of gravity, because of the high viscosity of such special ink for writing electrical circuits.

To write is applied to an electrical signal 11 to close the valve 9. The overpressure of the tank 7 is then applied to pipe 13, 21 and 4, which closes the valve 18 and propels the ink 22 down as a result of the compressed air pressure applied by the reservoir 2 the intermediary of the piping 4. The syringe 2 is then put in motion side to draw on the substrate 1 electric desired trait.

At the end of stroke, according to a characteristic of the invention, it is not enough to stop a lack of electrical signal to 11, placing in excess of 2 tank, but it applies also for a defined time an electrical signal to 19, allowing, by closing the valve 17, to the pipes 21, 13 and 4, depression tank empty 15, the anti-return valve 10 closing under the influence of aspiration . It thus enables ink 22 back along the entire length of the nozzle 3, and even a little in the example above considered, as shown in Figure 2. It shut down the electrical signal to 19, which reopens valve 17, and thus connect all the pipes 21, 13 and 4, and hence the upper part of the syringe 2, the atmospheric pressure by 10 valves and 18. De this way, the next phase of writing necessarily begin by setting a speed of 22 ink, which should go the whole length of the nozzle 3 before reaching its mouth 25, enabling it to acquire a fluidity to dtéviter defects writing at the beginning and end of line.

Reference is now in Figure 3 shows a diagram representative of the pressure on the syringe P 2 as a function of time t during the route of a line forming part of a cycle of writing a scheme electric given on a substrate. On this diagram, ltorigine the axis pressure P is set to atmospheric pressure.

The time scale is shown in milliseconds, for example purely indicative and not exhaustive.

As shown in the diagram, before the time $t = 0$ start writing trait, the pressure on the syringe 2 is the atmospheric pressure, the ink is supposed to lift up the nozzle, as represented on Figure 2.

At the time $t = 0$, corresponding to the top of writing trait, the pressure of writing P_e is applied to the syringe, its time to climb pression T_P being finished, and about 140 milliseconds in the diagram.

The writing is done for a time Y, 750 milliseconds in this example, during which the pressure P_e is maintained.

A depression ($-PV$) is then applied to the syringe 2, with a time of transition Y_1 , and is maintained for a time T_V , here 400 milliseconds, sufficient to allow the ink back up the nozzle (position represented Figure 2).

The syringe is then put to atmospheric pressure during a rest period T_R , around one second, then writing the following trait is triggered in the same way.

It fulfills several scripts successive traits forming an entire cycle of writing, for example corresponding to an electrical diagram determined on a substrate. This cycle of writing done, you are normally in the presence of a waiting period required before writing
 5 another electrical circuit, or portion of electrical circuit or on another substrate, either on the same substrate. This waiting time can be long, then we run the risk of substantial loss of fluidity of the ink contained in the syringe 2.

10 According to the invention or mitigates this difficulty by subjecting during the waiting time, paths and fro successive ink within the nozzle. Figure 4 shows the diagram of time on a cycle waiting according to this process.

As shown in Figure 4, the cycle of expectation is created by a succession of intervals following successive left to right on the chart

- 15 - the first time TV: aspiration of the same characteristics as the one on the time of the TV Figure 3, during which the ink back up the nozzle (about 400 milliseconds in this example)
- the first time TA: waiting time, around one second for example, during which the nozzle is under pressure atmosphérique
- 20 - the first tempsTP: putting pressure on the syringe sufficient to bring down the ink well into the mouth 25 of the nozzle without its kind outside, it is time to adjust TP depending on the type of ink, it is about a hundred milliseconds in general
- the second time TV: a new 400 milliseconds for a depression to allow the ink back up the nozzle
- 25 - TA second time: time to rest a second as before,
- etc ...

CLAIMS

1 / device intended to deposit the ink (22) on a substrate (1) towards the realization of electrical circuits, the type with a head of writing (2) and a remote control device (6, 14) command the supply of ink that head by creating an overpressure or depression, depending on whether one wants to trigger or stop writing, wherein the head of writing (2) is equipped d ' a nozzle (3) tube-shaped hair and glass, material or analog same physical and chemical properties.

2 / Process of implementation of the device according to claim 1, wherein to create, at the end of stroke, depression sufficient to allow the ink back into the nozzle on substantially the entire length of that thereof.

3 / The method of claim 2, wherein also to achieve, using that device for feeding (6, 14), a cycle of waiting between two cycles of writing with put pressure (TP) and depression (TV) shift and designed to make the ink paths and go back through the nozzle (13) without giving him the opportunity to get out outwards.